

AUG 19 1989

FEMI-209-080122

FLOOD INSURANCE STUDY



TOWN OF
DOLORES,
COLORADO
MONTEZUMA COUNTY



SEPTEMBER 29, 1989

Federal Emergency Management Agency

COMMUNITY NUMBER - 080122

NOTICE TO
FLOOD INSURANCE STUDY USERS

Communities participating in the National Flood Insurance Program have established repositories of flood hazard data for floodplain management and flood insurance purposes. This Flood Insurance Study may not contain all data available within the repository. It is advisable to contact the community repository for any additional data.

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FLOOD INSURANCE STUDY
TOWN OF DOLORES
MONTEZUMA COUNTY, COLORADO

1.0 INTRODUCTION

1.1 Purpose of Study

This Flood Insurance Study investigates the existence and severity of flood hazards in the Town of Dolores, Montezuma County, Colorado, and aids in the administration of the National Flood Insurance Act of 1968 and the Flood Disaster Protection Act of 1973. This Flood Insurance Study will be used to establish actuarial flood insurance rates and assist the community in their efforts to promote sound floodplain management. Minimum floodplain management requirements for participation in the National Flood Insurance Program (NFIP) are set forth in the Code of Federal Regulations at 44 CFR, 60.3.

This Flood Insurance Study was prepared by compiling pertinent information for the flood hazard areas in the Town of Dolores from existing technical and/or scientific data originally prepared by others for purposes other than the NFIP. This existing data was reviewed by the Federal Emergency Management Agency (FEMA) prior to its use in the development of this Flood Insurance Study to ensure compliance with NFIP regulations.

In some states or communities, floodplain management criteria or regulations may exist that are more restrictive or comprehensive than those on which these federally-supported studies are based. In such cases, the more restrictive criteria take precedence and the State (or other jurisdictional agency) will be able to explain them.

1.2 Authority and Acknowledgments

The sources of authority for this Flood Insurance Study are the National Flood Insurance Act of 1968 and the Flood Disaster Protection Act of 1973.

The hydrologic and hydraulic analyses for this Flood Insurance Study were performed by the U.S. Army Corps of Engineers (COE), Sacramento District, as reported in Flood Hazard Information, Dolores River and Tributaries, Dolores, Montezuma County, Colorado, September 1978 (Reference 1).

1.3 Coordination

On March 10, 1988, the results of this Flood Insurance Study were reviewed and accepted at a final coordination meeting attended by representatives of the community and FEMA.

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2.0 AREA STUDIED

2.1 Scope of Study

This Flood Insurance Study covers the incorporated areas of the Town of Dolores, Montezuma County, Colorado. The areas of study are shown on the Vicinity Map (Figure 1).

The areas studied by detailed methods were selected based upon the extent and validity of available existing hydrologic and hydraulic data.

The areas studied by detailed methods include: the Dolores River from a point approximately 900 feet downstream of the 4th Street Bridge upstream to a point approximately 100 feet downstream of Twenty-First Street extended; a study reach of approximately 1.33 miles.

2.2 Community Description

The Town of Dolores is located near the central area of Montezuma County in southwestern Colorado, approximately 39 miles south of San Juan County, Utah, and 40 miles west of La Plata County, Colorado. The drainage through the southern area of Dolores is the Dolores River, a tributary to the Colorado River. The Dolores River also has a tributary, the West Dolores River, which confluences about 15 miles upstream of Dolores, while the Dolores River confluences with the Colorado River in eastern Utah, approximately 100 miles northwest of the Town of Dolores.

Low brush dominates the lower elevations around Dolores, while higher drainage areas contain timber, including pine, fir, and spruce. Terrain in the Lost Canyon Creek area is interspersed with timber of pine and fir above 9,000 feet, with sagebrush and pinion pines flourishing in the lower tributary drainage area.

The normal annual precipitation in the area is approximately 16 inches (Reference 2). From July to October, nearly 40 percent of the normal annual precipitation occurs as snow. Winters are long and cold with mean daily temperatures around 30°F from November to March, while summers are short and hot with mean daily maximum temperatures greater than 90°F (Reference 3).

According to the U.S. Bureau of the Census, the population within corporate limits of the Town of Dolores decreased from 820 in 1970 to 802 in 1980 (Reference 4).

2.3 Principal Flood Problems

The nature of flooding problems affecting the Town of Dolores include: general frontal type rainstorms, convective type cloudbursts, and snowmelt. In this region, much of the annual

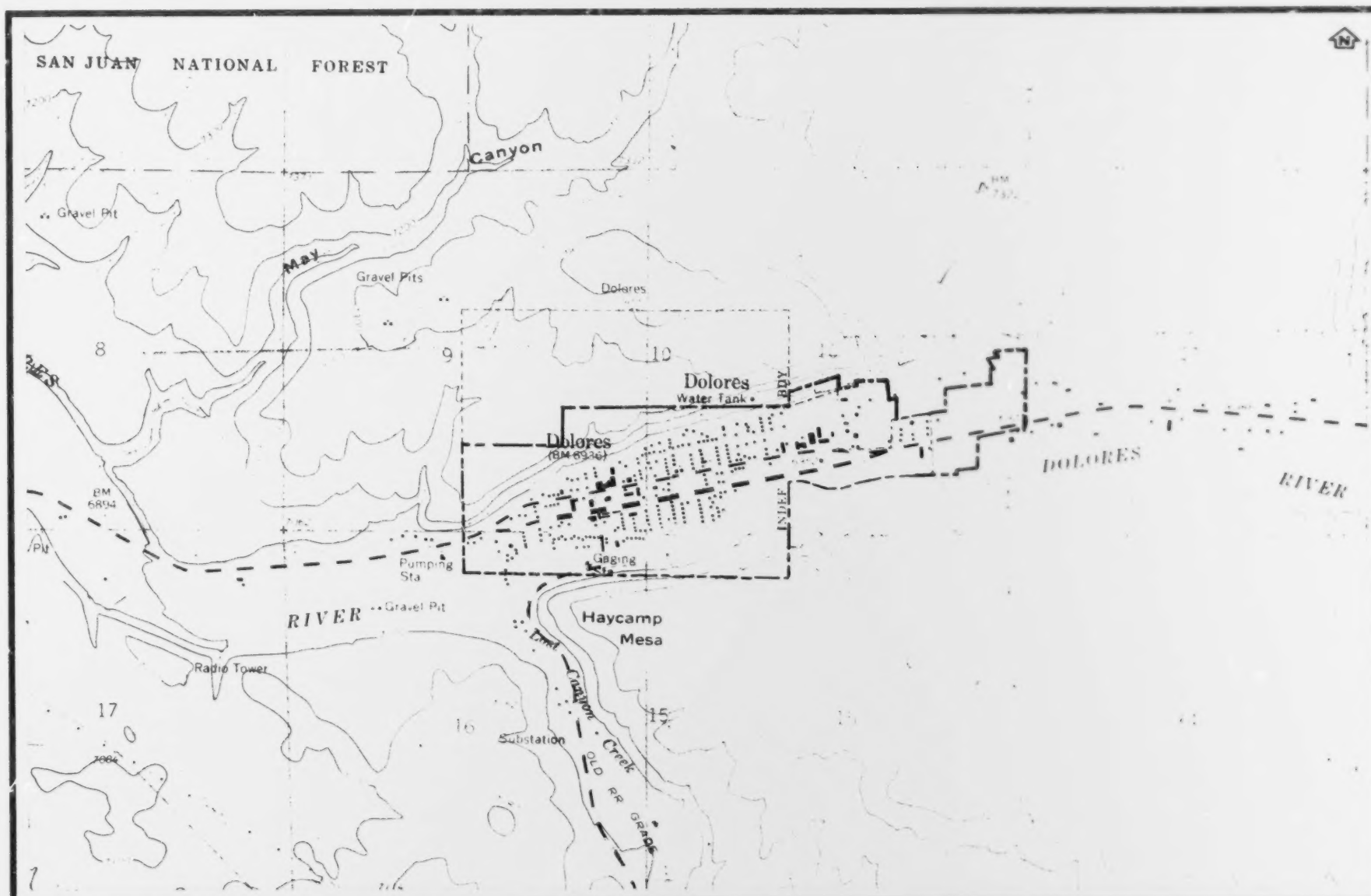
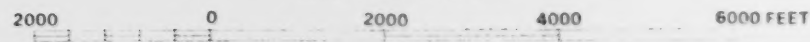


FIGURE 1

FEDERAL EMERGENCY MANAGEMENT AGENCY

TOWN OF DOLORES, CO.
(MONTEZUMA COUNTY)

APPROXIMATE SCALE



VICINITY MAP

precipitation occurs in the form of snow with deep snowpack developing in the higher elevations. Therefore, in the spring and early summer, runoff from melting snow presents a moderate and constant flood threat, but high peak flows are not characteristic of snowmelt runoff. Cloudburst storms constitute a severe flood threat along Lost Canyon Creek as high-intensity rainfall is produced, but due to the small areal extent, small volume of runoff, and short duration of this type of storm, a significant flood threat is present only in the smaller drainage basins.

Overall, however, frontal type rainstorms present the most serious flood hazard in the area studied. History proves this fact; in October 1911, the largest flood of record resulted from this type of storm on the drainage areas of the Dolores and West Dolores Rivers, flooding much of the Town of Dolores. Heavy rain along Lost Canyon Creek in October 1941 caused flooding in that area. In May 1941 and June 1949, large snowmelt flows occurred on the Dolores River. The most recent flooding occurred in September 1970, but the magnitude of flow of that flood was not recorded.

Historical records of flooding events on the Dolores River are primarily based on newspaper accounts, with indications that high water-surface elevations occurred in 1909, 1911, 1932, 1937, 1938, 1941, 1944, 1949, 1957, and 1970 (References 1 and 3). Flood loss in the study area usually consists of limited damage to bridges and irrigation structures.

2.4 Flood Protection Measures

In 1985 the U.S. Bureau of Reclamation completed construction of the Dolores landfill and protective dike. This project, which was built in conjunction with the Bureau's construction of the McPhee Dam, involved construction of 2,100 feet of levee and landfill between the State Route 145 embankment and the Fourth Street Bridge, along the right bank of the Dolores River. In addition, the project included the rehabilitation of two segments of existing levee along the right bank of the Dolores River upstream of the Fourth Street Bridge. These levees were constructed to prevent flooding resulting from the maximum pool elevation of the McPhee Reservoir. The levees upstream of Fourth Street do not have sufficient freeboard to be recognized as providing protection from 100-year overbank flooding. The landfill and levee upstream of State Route 145 were considered in this study regarding their effect on overbank flooding.

3.0 ENGINEERING METHODS

For the flooding sources studied by detailed methods in the community, standard hydrologic and hydraulic study methods were used to determine the flood hazard data required for this Flood Insurance Study. Flood events of a magnitude which are expected to be equaled or exceeded

once on the average during any 10-, 50-, 100-, or 500-year period (recurrence interval) have been selected as having special significance for floodplain management and for flood insurance rates. These events, commonly termed the 10-, 50-, 100-, or 500-year floods, have a 10-, 2-, 1-, and 0.2-percent chance of being equaled or exceeded during any year. Although the recurrence interval represents the long term average period between floods of a specific magnitude, rare floods could occur at short intervals or even within the same year. The risk of experiencing a rare flood increases when periods greater than one year are considered. For example, the risk of having a flood which equals or exceeds the 100-year flood (1-percent chance of annual exceedence) in any 50-year period is approximately 40 percent (4 in 10), and for any 90-year period, the risk increases to approximately 60 percent (6 in 10). The analyses reported herein reflect flooding potentials based on conditions existing in the community at the time of completion of this study. Maps and flood elevations will be amended periodically to reflect future changes.

3.1 Hydrologic Analyses

Hydrologic analyses were carried out to establish peak discharge-frequency relationships for each flooding source studied by detailed methods affecting the community.

Following guidelines established by the U.S. Water Resources Council, peak discharges of the 100-year flood were determined by utilizing a flow-frequency analysis of flows recorded at the "Below Rico" (1914-15, 1919-21, and 1952-Present), and "At Dolores" (1896-1903, 1911-12, and 1922-Present) stream gaging stations on the Dolores River, Gage Numbers 09165000 and 09166500, respectively. To determine the type of event that would cause the larger, less frequent floods, rain and snowmelt floods were separately statistically analyzed at the Dolores Gage. At the Rico Gage this type of analysis was never determined because of the short period of record.

Based on flows during September 1970, at the Rico and Dolores Gages, Snyder S-Curve and optimization techniques were used to develop unit hydrographs for the Dolores River. Optimization of the unit hydrograph for Lost Canyon Creek was achieved by using data from the October 13, 1941, storm and flood. Loss rates, consistent with previous studies done by the COE, Los Angeles District, and the U.S. Bureau of Reclamation, were calculated by the COE, Sacramento District, and found to be reasonable and accurate (Reference 1).

Peak discharge-drainage area relationships for the Dolores River, the West Dolores River, and Lost Canyon Creek are shown in Table 1.

TABLE 1 - SUMMARY OF DISCHARGES

<u>Flooding Source and Location</u>	<u>Drainage Area (Sq. Miles)</u>	<u>Peak Discharge (cubic feet per second)</u>			
		<u>10-Year</u>	<u>50-Year</u>	<u>100-Year</u>	<u>500-Year</u>
Dolores River downstream of the confluence of Lost Canyon Creek	567	6,800	11,500	14,500	36,000
Upstream of the confluence of West Dolores River	270	3,700	6,000	7,500	20,000
West Dolores River at mouth	167	2,300	3,800	4,800	11,500
Lost Canyon Creek at mouth	72	600	1,700	2,500	4,500

3.2 Hydraulic Analyses

Analyses of the hydraulic characteristics of flooding from the riverine sources studied were carried out to provide estimates of the elevations of floods of the selected recurrence intervals.

For flooding sources studied by detailed methods, other than shallow flooding areas, water-surface elevations for floods of selected recurrence intervals were computed through the use of the COE HEC-2 step-backwater computer program (Reference 1). Basic cross section input was derived from surveyed cross section information furnished by the Colorado Water Conservation Board.

Locations of selected cross sections used in the hydraulic analyses are shown on the Flood Profiles (Exhibit 1).

Starting water-surface elevations were based on the normal pool elevation of the McPhee Reservoir.

The profiles are used to determine depth of water in the channel and adjacent flooded areas. It has been determined that the 10-year flood would be contained within stream channels, and the 50-year flood would closely follow the pattern of the 100-year flood. Some areas are subject to sheetflow, broad, overland flooding less than 2-feet deep on the average, and characterized by unpredictable flow paths. In sheetflow areas, water-surface elevations are essentially independent of those along adjacent streamways, and are affected principally by obstructions and local topography in the area flooded.

Flood profiles were drawn showing the computed water-surface elevations for floods of the selected recurrence intervals.

The hydraulic analyses for this Flood Insurance Study are based on unobstructed flow. The flood elevations shown on the profiles are thus considered valid only if hydraulic structures remain unobstructed, operate properly, and do not fail.

all elevations are referenced to the National Geodetic Vertical Datum of 1929 (NGVD). Elevation reference marks used in this study are shown on the maps.

4.0 FLOODPLAIN MANAGEMENT APPLICATIONS

The NFIP encourages State and local governments to adopt sound floodplain management programs. Therefore, each Flood Insurance Study includes a floodplain boundary map designed to assist communities in developing sound floodplain management measures.

4.1 Floodplain Boundaries

To provide a national standard without regional discrimination, the 1 percent annual chance (100-year) flood has been adopted by FEMA as the base flood for floodplain management purposes. For each stream studied by detailed methods, the 100-year floodplain boundaries have been delineated using the flood elevations determined at each cross section.

Between cross sections, the boundaries were interpolated using topographic maps at a scale of 1:400, with contour intervals of 2 feet and 10 feet NGVD (Reference 1).

The 100-year floodplain boundaries are shown on the Flood Insurance Rate Map (FIRM) (Exhibit 2). On this FIRM, the 100-year floodplain boundary corresponds to the boundary of the areas of special flood hazards (Zone AE and AO). Small areas within the floodplain boundaries may lie above the flood elevations but cannot be shown due to limitations of the map scale and/or lack of detailed topographic data.

4.2 Floodways

Encroachment on floodplains, such as structures and fill, reduces flood-carrying capacity, increases flood heights and velocities, and increases flood hazards in areas beyond the encroachment. One aspect of floodplain management involves balancing the economic gain from floodplain development with the resulting potential increase in flood hazard. For purposes of the NFIP, a floodway is used as a tool to assist local communities in this aspect of floodplain management. Under this concept, the area of the 100-year floodplain is divided into a floodway and a floodway fringe. The floodway is the channel of a stream, plus any adjacent floodplain areas that must be kept free of encroachment so that the 100-year flood can be carried without any substantial increase in flood height. Minimum federal standards limit such increases to 1.0 foot, provided that hazardous velocities are not produced.

Floodways were not determined for this Flood Insurance Study.

5.0 INSURANCE APPLICATION

For flood insurance rating purposes, flood insurance zone designations are assigned to a community based on the results of the engineering analyses. These zones are as follows:

Zone AE

Zone AE is the flood insurance rate zone that corresponds to the 100-year floodplains that are determined in the Flood Insurance Study by detailed methods. In most instances, whole-foot base flood elevations (BFEs) derived from the detailed hydraulic analyses are shown at selected intervals within this zone.

Zone AO

Zone AO is the flood insurance rate zone that corresponds to the areas of 100-year shallow flooding (usually sheet flow on sloping terrain) where average depths are between 1 and 3 feet. Average whole-foot depths derived from the detailed hydraulic analyses are shown within this zone.

Zone X

Zone X is the flood insurance rate zone that corresponds to areas outside the 500-year floodplain, areas within 500-year floodplain, areas of 100-year flooding where average depths are less than 1 foot, areas of 100-year flooding where the contributing drainage area is less than 1 square mile, and areas protected from the 100-year flood by levees. No BFEs or depths are shown within this zone.

6.0 FLOOD INSURANCE RATE MAP

The FIRM is designed for flood insurance and floodplain management applications.

For flood insurance applications, the FIRM designates flood insurance rate zones as described in Section 5.0 and, in the 100-year floodplains that were studied by detailed methods, shows selected whole-foot BFEs or average depths. Insurance agents use the zones and BFEs in conjunction with information on structures and their contents to assign premium rates for flood insurance policies.

For floodplain management applications, the FIRM shows by tints, screens, and symbols, the 100-year floodplain, and the location of selected cross sections used in the hydraulic analysis.

7.0 OTHER STUDIES

This Flood Insurance Study was prepared by compiling existing hydrologic and hydraulic technical and scientific data prepared by other organizations originally for purposes other than the NFIP. The data was identified as the best available at the time of compilation of this Flood Insurance Study, and should depict the general conditions of the flooding sources with relative accuracy. FEMA performed a cursory review and accepted the data as valid for purposes of this Flood Insurance Study and the NFIP. However, if better information is known to exist or has been developed since the date of this Flood Insurance Study, the information should be immediately forwarded to the Chief, Natural and Technological Hazards Division, FEMA, Denver Federal Center, Building 710, Box 25267, Denver, Colorado 80225-0267 for consideration for revision of this Flood Insurance Study.

A Flood Insurance Study for the unincorporated areas of Montezuma County, Colorado, is presently being prepared (Reference 7). The results of that FIS will be in complete agreement with this Flood Insurance Study.

A Flood Hazard Boundary Map (FHBM) has been published for the community (Reference 6). The differences between the FBHM and this Flood Insurance Study are justified due to the more detailed nature of this Flood Insurance Study.

This Flood Insurance Study either supersedes or is compatible with all previous studies published on streams studied in this Flood Insurance Study and should be considered authoritative for the purposes of the NFIP.

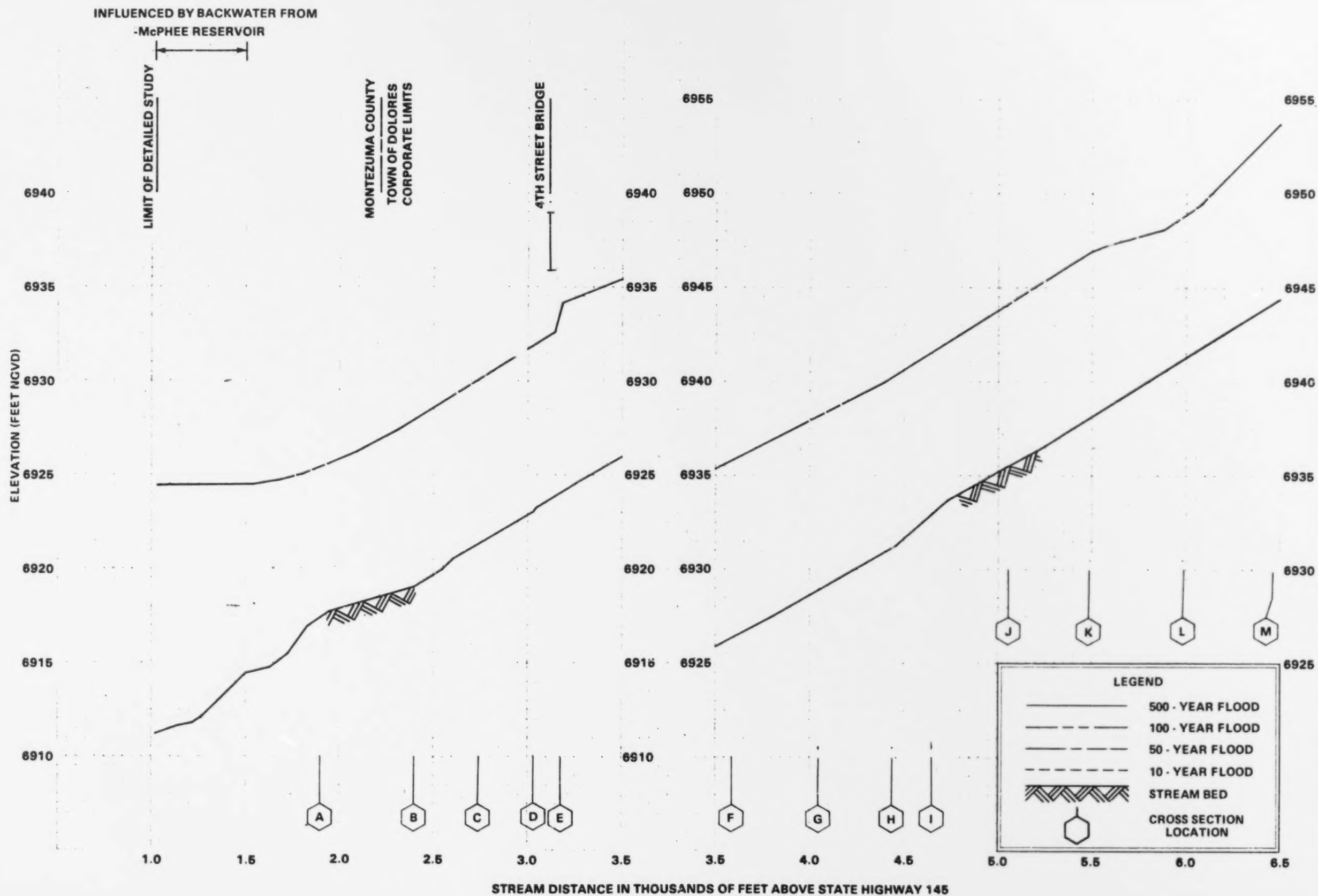
8.0 LOCATION OF DATA

Information concerning the pertinent data used in the preparation of this Flood Insurance Study can be obtained by contacting the Chief, Natural and Technological Hazards Division, FEMA, Denver Federal Center, Building 710, Box 25267, Denver, Colorado 80225-0267.

9.0 BIBLIOGRAPHY AND REFERENCES

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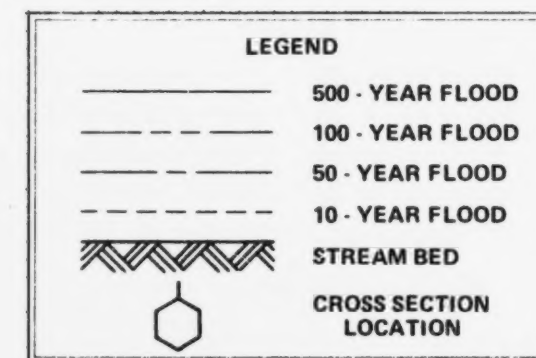
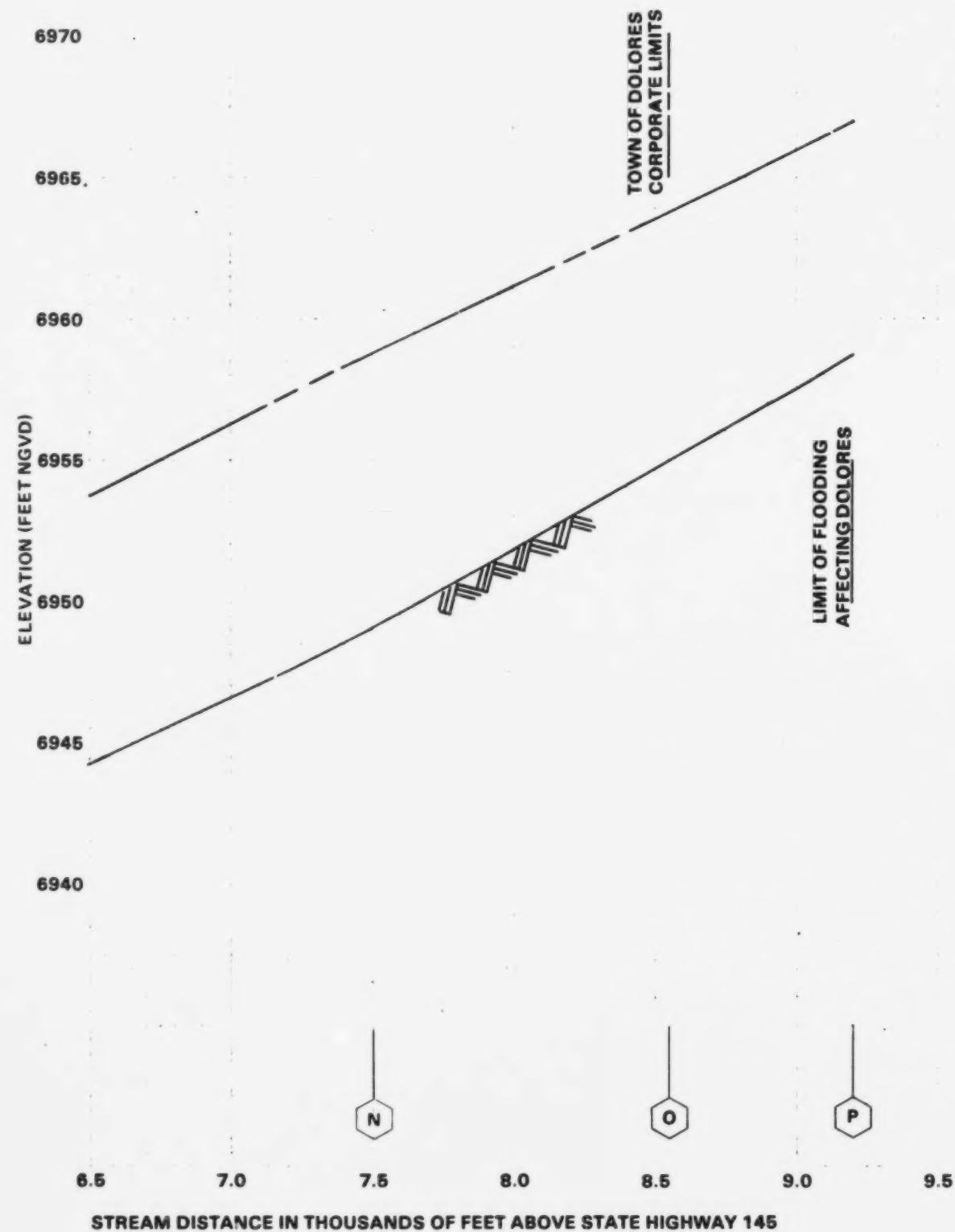
FLOOD PROFILES

DOLORES RIVER

FEDERAL EMERGENCY MANAGEMENT AGENCY

TOWN OF DOLORES, CO
(MONTEZUMA CO.)

01P



FLOOD PROFILES

DOLORES RIVER

FEDERAL EMERGENCY MANAGEMENT AGENCY

TOWN OF DOLORES, CO
(MONTEZUMA CO.)

02P

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